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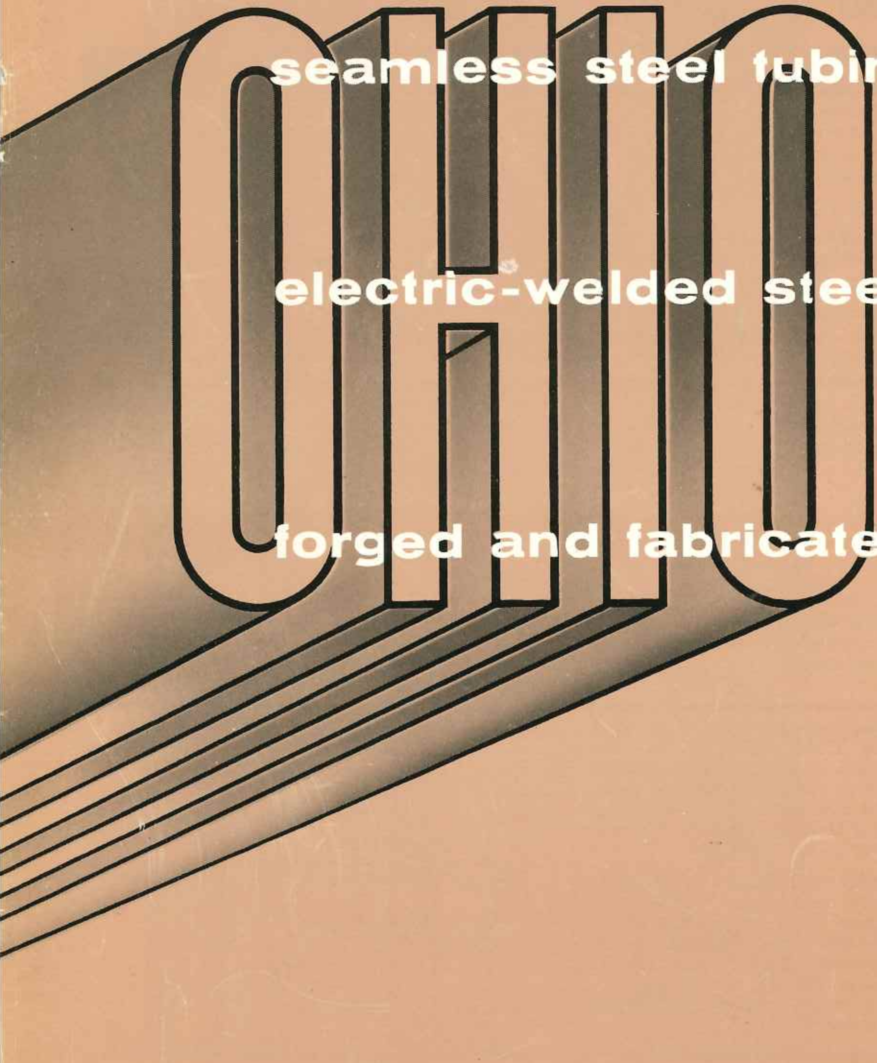


seamless steel tubing

MECHANICAL
AIRCRAFT / AIRFRAME

electric-welded steel tubing

MECHANICAL
COLD DRAWN
PRESSURE
STRUCTURAL

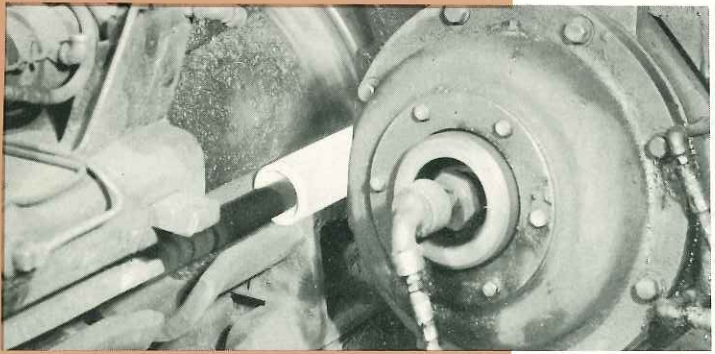
forged and fabricated steel tubular parts

OHIO SEAMLESS TUBE

Division of Copperweld Steel Company • **SHELBY, OHIO**

Seamless and Electric Resistance Welded Steel Tubing • Fabricating and Forging

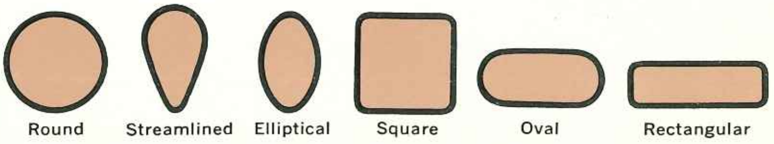
OHIO steel tubing



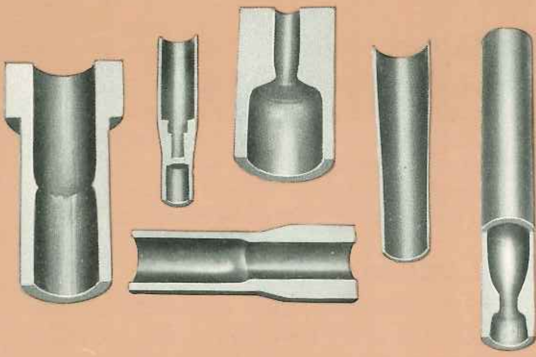
The name OHIO on steel tubing is the hallmark of the highest degree of skill in the tube maker's art . . . the greatest depth of experience in producing quality steel tubing, for it was here in Shelby that the seamless steel tubing industry in America was born.

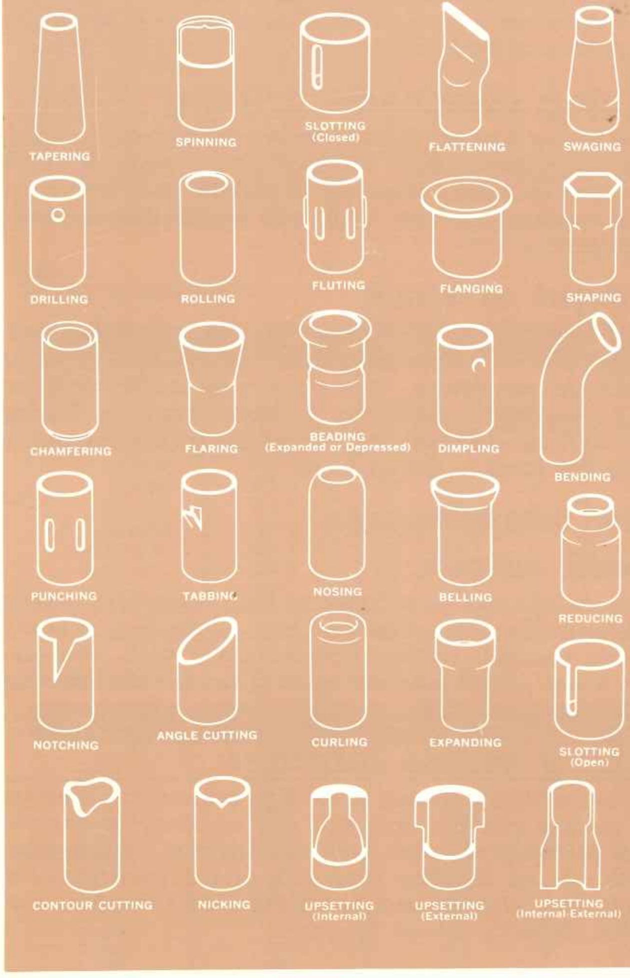
Ohio Seamless is a complete producer of quality steel tubing—complete in range of products from seamless mechanical through electric resistance welded tubing in parallel size ranges. This means Ohio Seamless can recommend the best type, either seamless or welded, to suit your own particular needs.

Add to this Ohio's production capabilities to perform secondary processing, as well as fabricating and forging, and you have a single source of responsibility that provides a custom tailoring service to produce steel tubing to fit most customers' needs most often.

	Characteristics	Applications	Sizes
Seamless Steel Tubing **Mechanical**—Cold finished carbon and alloy in the range of sizes and analyses shown in detail on Page 5. **Cold Finished**—Cold drawn or tube reduced providing closer dimensional accuracy, improved surface, higher mechanical properties. **Hot Finished**—Processed in suitable sizes and grades through conventional plug mill or Assel mill facilities for maximum concentricity and machinability.	Mechanical seamless steel tubing is steel in its strongest, most versatile shape. Unequalled strength/weight ratio, wide selection in dimensions and materials. Cold working of both outside and inside diameters effects exact dimensions, fine finish, improved structure and physical values. Tolerances and surface similar to other hot worked steel products—a diamond in the rough. Economical material where machining and heat treatment is intended.	General. Used statically or dynamically in machine construction as structural members or as machined or fabricated parts in assembly. Cylindrical shape often permits multi-functional use. In condition received permits application varying from basic raw material to finished part. For specific applications see more complete data on Page 4.	Cold Finished ¼″ O.D. to 7″ O.D. .028″ to 1.250″ Wall (See Page 5). Hot Finished. Subject to mill review.
Airframe / Aircraft Mechanical **Airframe Quality**—Cold drawn only, in carbon and alloy grades, processed to provide special surface and mechanical qualities and other requirements of aircraft production.	Excellent surface quality, dimensional accuracy and strength values not ordinarily obtainable in other grades. (Specialty of the House.)	To take advantage of airframe quality described, material is intended for use in condition supplied for such applications as structural airframe members, engine mounts, braces, seat frames, control surfaces and other airborne parts and accessories.	³⁄₁₆″ O.D. to 4″ O.D. .028″ to .250″ Wall.
Aircraft Mechanical—Made cold drawn or hot rolled from Magnaflux quality alloy steel, specially processed for maximum machinability.	Emphasis on internal values—structural soundness, machinability, hardenability, in expectation of complete machining and thermal treatment by user.	Intended for over-all machining and heat treatment for critical stressed parts—axles, shock struts, landing gear assemblies, motor parts, gears.	(Same as mechanical seamless above.)
Electric Resistance Welded Tubing **Mechanical**—Produced from cold rolled or hot rolled carbon steel strip and sheet in round, square, rectangular and other shapes. **Cold-Drawn**—Also supplied for special sizes, finishes, tolerances and mechanical properties. **Pressure**—Produced from selected, fully aluminum killed raw material, normalized after welding, rigidly tested (destructively and non-destructively) to insure sound, uniform weld and conformance to ASTM and ASME specifications.	Uniformity in wall thickness, excellent fabricating qualities. Cold rolled affords close limits on hardness and gauge, and smooth, dense surface. Hot rolled has broader gauge tolerances, lower hardness, dull but scale-free surface with ideal bonding qualities for paint or other similarly applied finishes. Gauge uniformity and surface smoothness contribute to even heat transfer and free flow of liquids or gases in pressure applications. Normalizing insures uniform structure and ductility for bending, flaring. Selected raw material, careful processing, extra testing and inspection assure sound product. Economical when properly applied.	Particularly applicable where weight or mass limitation, appearance, gauge uniformity, economy are paramount considerations. Important to design around standard sizes. For typical mechanical applications see Page 6. For typical pressure applications consult Page 6.	½″ O.D. to 7½″ O.D. .028″ to .375″ Wall (Hot rolled in .065″ and heavier). (See Page 7.)
Forging and Fabricating In-plant facilities for upsetting, swaging, tapering, bending, expanding, reducing, slotting and many other operations on both seamless and welded. Special tooling produced at cost.	Determined basically by the type of tubing used, as described above. For some operations, such as upsetting and swaging, tube is heated. Dimensional and surface characteristics of hot finished material prevails in heated portions. Economy greatest when design avoids sharp contour changes, close tolerances, or other extremes.	Upset drill rods, swaged rollers and shafts, automotive parts and accessories, handles, sweeper wands, agricultural equipment, hand and power tools, toys.	Within above limits for type of tube used, subject to range of forming equipment.
Shapes Many special shapes (typical sections at right) supplied in both seamless and welded by turks-head forming, cold drawing, tube reducing, or by press work on short or partially shaped pieces.	 Round Streamlined Elliptical Square Oval Rectangular		Seamless—Up to but not including 5″ major O.D. dimension, maximum wall .250″ to .313″. Welded—7½″ major O.D. dimension, maximum wall approximately .250″. Subject to mill review.

OHIO secondary operations





Fabrication and forging of Ohio Steel Tubing provides customers with finished components tailored exactly to their product. Besides the advantage of ready-to-use status, the inherent and structural advantages of steel tubing from the standpoints of torsion, compression, vertical loading, shock unit design and structural resistance are retained and, in many cases, enhanced.

The experience and skill of Ohio Seamless Tube master craftsmen in producing, fabricating and forging seamless and welded steel tubing make OHIO a unique source for complete steel tubing requirements. Modern facilities for a wide variety of fabricating and forging operations are of particular benefit to smaller plants with limited machining capabilities, or for those plants wishing to reduce or eliminate machining operations.

Substantial savings may be realized by use of steel tubing for machined parts. Generally speaking, any part requiring considerable internal work can be processed more economically from tubing.

Bar stock, often costing less per pound than tubing, may cost more per finished piece because of the waste weight that must be shipped and then machined from the center. Also, cost of tubing is offset by a sharp reduction in machining time and increased production.

Forging

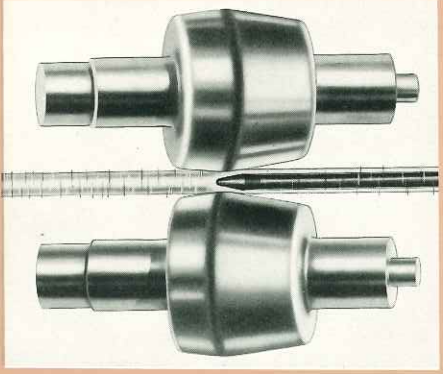
Forging refers to the forming of tubular parts which, because of the original tube size or the nature of the forged section, require heating of the tube in the area to be formed. Such forged parts have the finish and dimensional characteristics of other hot worked steel products. While other shapes can be produced, upsetting (external, internal, or external-internal) and swaging are the main types of forging the mill is best equipped to handle.

Fabricating

Fabrication refers to any cold process by which tubing is modified in shape or cross section in accordance with a specific design. The inherent and structural advantages of tubing are retained, and often increased, through fabrication. Frequently fabrication is the only answer to a design problem. We are equipped to perform all of the following and many other operations in our own plant:

Tapering
Swaging
Flanging
Expanded Beading
Depressed Beading
Expanding
Spinning
Drilling
Shaping
Dimpling
Slotting
Belling
Notching
Open Slotting
Closed Slotting
Upsetting (External, Internal, External-Internal)
Rolling
Chamfering
Bending
Tabbing
Joining
Angle Cutting
Contour Cutting
Flattening
Fluting
Flaring
Punching
Nosing
Reducing
Curling
Nicking

OHIO seamless steel tubing



Mechanical

Mechanical Seamless Steel Tubing is used either statically or dynamically in machine construction for such structural parts as bearing races, rods, spacers, gears, shafts, etc. Special physical properties or surface smoothness, dimensional accuracy, machinability and suitability for carburizing or heat treatment make the list of uses virtually limitless. It is made to special sizes and/or shapes and sometimes to special surface finishes. Typical Usage: Hydraulic cylinders and piston tubes, automobile parts and accessories, bearings and races, mining and drilling equipment, printing press rolls, conveyor rolls, pins and bushings.

Cold worked

Cold working of seamless steel tubing is accomplished on draw benches or tube reducing machines to provide greater size selection, particularly in smaller diameters and lighter gauges, and to produce more exact dimensions, improve surface quality, increase mechanical properties. In the tubular form—uniquely—cold working can be applied to both **inside** and **outside** surfaces, and the resultant reduction of area and elongation reflect in great refinement of the material, with strength and structure characteristics greatly improved.

Hot worked

Hot finished mechanical tubing is produced by OHIO by rotary piercing, plug or Assel mill rolling, and final processing through multiple-pass sizing-reducing mills. Tolerances and finish are similar to other hot worked steel products, and the range of sizes and grades is more restricted than cold finished by the nature of the processing involved.

Applicable for structural purposes where dimensional accuracy and surface quality are unimportant or secondary, or where desired tolerances, finish and final mechanical properties are to be attained by machining and heat treatment.

Airframe and aircraft

Seamless steel tubing used in aircraft and engines is normally identified either as Airframe Quality Tubing, or as Aircraft Mechanical Tubing. Each has its own characteristics and applications.

Airframe Quality Tubing is made cold drawn only from open hearth or electric furnace steel and satisfies all requirements of Aeronautical tubing specifications. This class of tubing has special surface and mechanical qualities and other characteristics which are suitable for aircraft construction. If aircraft Magnaflux quality steel is mandatory, so specify when ordering, as special handling is necessary.

Aircraft Mechanical Tubing is either cold drawn or hot rolled and is produced from aircraft Magnaflux quality steel having qualities suitable for highly stressed parts such as axles, shock absorbers, landing gears, engine parts, etc.

Advantages

A cylindrical or round part with a hole in the center usually costs less to machine from tubing than from solids. Savings are determined by four important factors: Cost of material; weight of stock; machining of hole in part; temperature of work during machining. Effect of these factors is far greater than the apparent values normally assigned to them.

Cost of materials

The important consideration in cost of materials, and the difference between profit and loss, is cost per finished piece —not cost per pound of stock. Bar stock frequently costs less per pound than tubing, but generally costs much more per piece because much of its weight is in the center where it must be drilled out.

Tubing eliminates drilling

Since tubing is partly finished, heavy drilling is eliminated, thus also reducing wear and tear on the machine. Light cuts used on tubing favor use of carbide tools with their rapid cutting, superior finish and longer time between resharpening.

Weight of stock

Since weight per foot of tubing is lower than bar stock, tubing costs less to handle and can often be used in longer lengths in automatics. This gives more machined pieces per loading, and a smaller percentage of crop ends. Tubing also saves by reducing downtime for charging magazines or loading stock in the machine.

Low temperatures speed output

Since coolant can be supplied to both inside and outside tools on tubing, this, combined with elimination of heavy drilling, results in reduced temperature of work. Evaporation losses of coolant are reduced, and higher cutting speeds are permissible.

Tubing versus forgings

The use of tubing instead of solid forgings makes substantial savings possible since it is not necessary to hog out large quantities of metal. Another important consideration is the reduced chucking time with tubing, particularly in automatics, as compared to the individual chucking and double chucking of each forging.

Seamless size range

minimum and maximum size range

maximum finished lengths in feet *

Wall Thickness		OUTSIDE DIAMETER																																
BWG	Dec. Equiv.	¼"	⅜"	½"	⅝"	¾"	⅞"	1"	1⅛"	1¼"	1⅜"	1½"	1¾"	2"	2¼"	2½"	2¾"	3"	3¼"	3½"	3¾"	4"	4¼"	4½"	4¾"	5"	5¼"	5½"	5¾"	6"	6¼"	6½"	6¾"	7"
22	.028			25	25	25	25	25	25																									
21	.032	25	25	25	25	25	25	25	25																									
20	.035	25	25	25	25	25	25	25	25	25	25	25	25																					
19	.042	25	25	25	25	25	25	25	25	25	25	25	25																					
18	.049	25	25	25	25	25	25	25	25	25	25	25	25	25	22																			
17	.058	25	25	25	25	25	25	25	25	25	25	25	25	25	22	22	22																	
16	.065	25	25	30	25	25	25	25	25	25	25	25	25	25	24	24	24	22																
15	.072	25	25	30	25	25	25	25	25	25	25	25	25	25	25	25	24	24	26															
14	.083	25	30	30	30	30	30	25	25	25	25	25	25	30	30	30	30	30	30	30														
13	.095	25	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	28													
12	.109		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	28	28												
11	.120		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	28	28												
10	.134		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	28	28	28											
9	.148		30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	27	30	26	28	28	28											
⁵⁄₃₂"	.156			30	30	30	30	30	30	30	30	30	30	30	30	30	29	27	30	26	28	28	28	27										
8	.165			30	30	30	30	30	30	30	30	30	30	30	30	30	29	27	28	26	28	27	28	27										
7	.180			30	30	30	30	30	30	30	30	30	30	30	30	30	27	27	28	26	28	27	27	27	27	26								
6	.203			30	30	30	30	30	30	30	30	30	30	30	30	29	27	27	27	25	26	27	27	27	26	26								
5	.220				30	30	30	30	30	30	30	30	30	30	30	29	27	25	26	25	26	26	26	26	26	26								
4	.238				30	30	30	30	30	30	30	30	30	30	30	29	27	24	26	24	26	26	26	25	26	25								
¼"	.250					30	30	30	30	30	30	30	30	30	30	29	27	24	26	24	26	26	26	25	25	25	25	23						
3	.259					30	30	30	30	30	30	30	30	30	30	29	27	24	26	24	26	25	26	25	25	24	25	23						
2	.284						30	30	30	30	30	30	30	30	29	28	26	24	25	24	25	25	26	25	25	24	25	23						
1	.300						30	30	30	30	30	30	30	30	29	26	26	24	25	24	25	25	25	25	25	24	25	23						
⁵⁄₁₆"	.313								30	30	30	30	30	30	29	26	26	24	25	24	25	25	25	25	25	24	25	25	23	23				
⅜"	.375												30	30	30	25	23	23	24	24	24	24	24	24	24	24	24	24	24	23	23	22	22	21
⁷⁄₁₆"	.438													27	30	28	26	23	23	21	23	23	23	24	23	23	23	23	23	22	22	22	22	21
½"	.500													30	30	28	25	23	23	21	21	21	22	22	22	22	22	23	22	22	22	22	22	21
⁹⁄₁₆"	.563													30	29	26	24	23	23	21	20	21	21	20	22	21	22	22	22	22	22	22	21	20
⅝"	.625															26	23	23	23	21	21	21	21	20	19	19	21	22	21	21	21	21	21	20
¹¹⁄₁₆"	.688															24	21	23	23	20	21	21	21	20	19	18	19	18	16	20	20	20	20	19
¾"	.750																26	23	23	20	21	21	20	19	19	19	19	17	16	20	20	20	20	19
¹³⁄₁₆"	.813																	22	23	21	21	20	20	19	19	18	18	17	16	19	19	19	19	
⅞"	.875																	21	23	21	20	20	20	19	19	18	18	17	15	18	18	19	19	
¹⁵⁄₁₆"	.938																	25	22	20	20	19	19	19	18	18	17	17	15	17	17	18	18	
1"	1.000																	24	21	19	19	19	19	19	18	17	17	17	16	16	16	17	16	
1¹⁄₁₆"	1.063																				18	18	19	19	18	17	17	17	16	15	15	16		
1⅛"	1.125																					18	19	18	18	17	17	17	15	14	14	15		
1³⁄₁₆"	1.188																						18	17	17	17	17	16	15	14				
1¼"	1.250																							17	16	16	17	16	15	13				

*Example: 3″ O.D. x ¼″ Wall

Max. Finished Length 24′.

Ohio Seamless produces all intermediate sizes (other fractions or decimal equivalents) of cold drawn seamless steel tubing within the minimum and maximum size range shown.

Limitations may apply to certain grades of cold drawn seamless tubing in sizes within the range of this chart. Therefore, the chart should be used only as a guide.

Tolerances

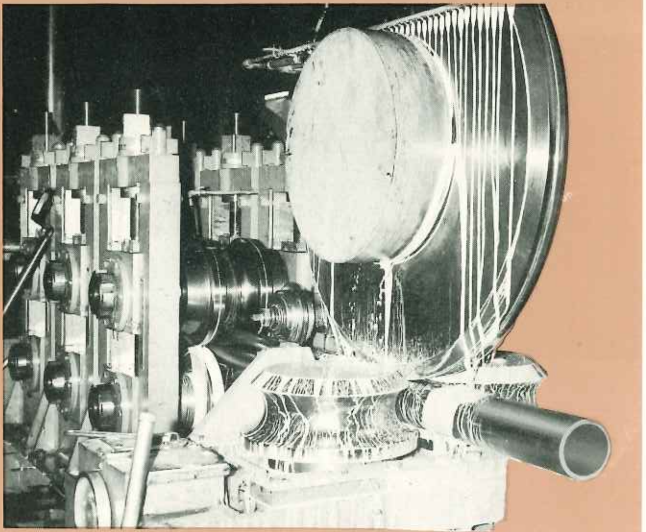
USUAL PERMISSIBLE TOLERANCE									STRAIGHTNESS		
COLD DRAWN	O. D.		I. D.			HOT ROLLED	O. D.				
size O. D.	over	under	over	under	thickness % over / under	size O. D.	over	under	size limits	maximum curvature in lengths of 3 feet	maximum curvature for lengths under 3 feet
³⁄₁₆ to ½	.004	.000				under 3	.023	.023			
½ to 1½	.005	.000	.000	.005	10	3 to 5½	.031	.031	O.D. 5" and smaller. Wall thickness, over 3% of O.D. but not over .500"	.030"	.010" per ft.
1½ to 3½	.010	.000	.000	.010	10	5½ to 7	.047	.047			
3½ to 5½	.015	.000	.005	.015	10						
(a) 5½ to 7	.030	.030	.035	.035	10				O.D. over 5" to 7". Wall thickness, over 4% of O.D. but not over .750"	.045"	.015" per ft.
(b) 5½ to 7	.020	.020	.025	.025	10						
(c) 5½ to 7	.030	.000	.015	.030	10						

O.D. and wall thickness (dimensions in inches) (a) Wall less than 5% of O.D. (b) Wall from 5% to 7.5% of O.D. (c) Wall over 7.5% of O.D.

Material specifications

AISI/SAE No.	AISI/SAE No.	AISI/SAE No.	AISI/SAE No.	AISI/SAE No.	AISI/SAE No.	AISI/SAE No.	AISI/SAE No.
C 1010	C 1041	1335	4047	4340	5132	8617	8740
C 1015	C 1045	1340	4063	E 4340	5135	8620	8742
C 1016	C 1046	1345	4068	4615	5140	8622	8822
C 1017	C 1050	E 2517	4118	4617	5145	8625	9255
C 1018	C 1052	3135	4130	4620	5147	8627	9260
C 1019	C 1055	3140	4135	4621	5150	8630	9261
C 1020	C 1060	E 3310	4137	4640	5155	8637	9262
C 1022	C 1065	4012	4140	4720	5160	8640	E 9310
C 1024	C 1070	4023	4142	4815	E 50100	8642	E 9314
C 1025	C 1075	4024	4145	4817	E 51100	8645	9840
C 1026	C 1080	4027	4147	4820	E 52100	8650	9850
C 1030	C 1085	4028	4150	5015	6120	8655	
C 1035	C 1090	4032	4320	5046	6150	8660	Other grades upon application.
C 1036	C 1095	4037	4337	5120	8115	8720	
C 1040	1330	4042	E 4337	5130	8615	8735	

OHIO resistance welded steel tubing



As a welded tubing producer our name—Ohio *Seamless* Tube—may be misleading. True, Ohio was a world-famous seamless manufacturer long before the idea of electric resistance welded tube was conceived. But we are proud of the fact that Ohio was one of the very first seamless mills not only to recognize the advantages of welded steel tubing but to vigorously promote its sale along with seamless.

Ohio has produced quality electric resistance welded steel tubing since 1937, which makes us one of the pioneers in the field. Ever-broadening acceptance of Ohio welded tubing led to a multi-million dollar expansion program completed in early 1961. Our size range has been extended to unprecedented limits and our capacity increased by more than 10 times!

Even more important than facilities and capacity is Ohio's backlog of priceless experience. Here in Shelby, Ohio, birthplace of the seamless tube industry in America, we have specialized in steel tube production since 1890. Here tube making is the honored profession. Here, more than anywhere else in the world, you will find people experienced in the craft of developing, making, fabricating and applying steel tubing.

While the basic raw material is expensive, the resistance welding of steel tubing is a high speed, versatile process which permits production of quality steel tubing at an economical price.

In the tube forming process, flat stock is fed continuously from coils through forming rolls which gradually shape it to the form of a circle. Then the butted edges are resistance welded together to make a continuous tube wall. The excess metal left on the inside and outside of the tubing by the welding operation is commonly referred to as weld flash. This weld flash is always removed from the outside of the tubing; it may or may not be removed from the inside of the tubing, depending upon the customers' requirements.

Welded tubing is generally formed slightly oversize. Immediately following the welding operation, the tubing passes through a series of rolls which cold work it to final size and tolerance. Traveling cut-off mechanisms of various types cut the tubing into mill lengths for convenient handling while continuous operation is maintained.

OHIO WELDED STEEL TUBING is produced within the range of sizes and in the grades shown on Page 7.

COLD ROLLED or HOT ROLLED steel may be specified on Grades 1 through 4. Cold rolled tubing is specified when close limits on hardness and gauge are required. Tubing made from cold rolled steel is used where close tolerance in inside diameter or gauge is required, where a quality finish is necessary for polishing or plating, and where close control of temper or hardness is needed.

Hot rolled tubing differs from cold rolled in that limits on thickness have wider permissible variation. Due to this variation, it is not economically practical to hold tube to close I.D. tolerances; O.D. tolerances can be held to same limits as in cold rolled tubing. Surface on hot rolled steel is not of such high quality as on cold rolled, but is free from scale. In cases where a lacquer or paint finish is required, hot rolled is preferred because paint adheres more satisfactorily.

OHIO WELDED is regularly produced in standard AISI C1010 to 1025 inclusive. Other analyses with higher carbon or manganese, low alloy-high tensile steels, or grades with special temper, surface or quality characteristics can be supplied.

Cost is lowest and availability greatest with C1010 and C1020.

Applications and advantages

Typical for OHIO RESISTANCE WELDED STEEL TUBING: Agricultural machinery, air conditioning equipment, appliances, automotive parts and accessories, bathroom fittings, bicycles, conveyor rollers, dental equipment, grease guns, handles, lawn-mowers, lubricating systems, office equipment, racks, road machinery, signal devices, spraying and dusting equipment, stoves, sweepers and tools.

For certain applications, OHIO WELDED STEEL TUBING has definite advantages in cost, surface condition and fabricating properties. Because the operation starts with a coil of steel which has been rolled to a specified thickness, numerous processes have been eliminated which would ordinarily be required to establish uniform wall thickness, thus effecting a cost saving and assuring desirable surface qualities.

OHIO Welded Steel Tubing can be beaded, expanded, swaged, spun, flanged, grooved, flattened, tapered or otherwise changed in cross section to meet an almost endless variety of design requirements. With proper equipment, it can be bent in any direction, has a uniform finish suitable for enameling, plating, etc., and is adaptable to any standard method of joining, either mechanical, or by brazing or welding.

Your inquiries and orders are invited for . . .

- **Ohio Welded Mechanical**
- **Ohio Drawn-Welded**
  - Mechanical Applications.
  - Commercial and Special Smooth for Cylinder Applications.
- **Ohio Welded Pressure**
  - Produced from premium steels, rigidly tested (air, water or eddy current) to insure conformance to ASTM and ASME specs.
- **Ohio Welded Structural Shapes**
  - Squares, Rectangles.
- **Ohio Welded Fabricated—Forged**
  - In-plant facilities to produce finished or semi-finished tubular parts.

We carry large, flexible raw material inventories, and have extensive supplementary facilities for cold drawing, annealing and normalizing, straightening, cutting, inspecting and testing. These resources are conscientiously applied to your tubular requirements to supply Ohio's "CUSTOM-MADE QUALITY."

It costs no more—in many cases, far less in the end—to have your tubing orders *Custom-Made*. Capitalize on Ohio's "CUSTOM-MADE QUALITY" by telling us *exactly* what you need when you send your inquiries and orders.

Welded size range

Table below shows the popular sizes available in Ohio Electric Resistance Welded Steel Tubing. Many other sizes, not shown, can be produced, depending on quantity, surface requirements, delivery and other factors. Check mill direct for details. Referring to grades explained below chart, direct from welder Grades 1, 2 and 3 may also be specified in other common fractional wall thicknesses, such as ⅛ (.125), 5/32 (.156), 3/16 (.188), ¼ (.250), etc. On drawn Grades 4 and 5 intermediate diameters and wall thicknesses are readily available. For example, on drawn over mandrel tube, a size like 4.460″ OD x .245″ wall may be ordered if it will serve the purpose better than a "standard" 4.500″ OD x .250″ wall—at no extra cost.

OD	22 .028	20 .035	18 .049	16 .065	14 .083	13 .095	12 .109	11 .120	10 .134	9 .148	8 .165	7 .180	6 .203	5 .220	4 .238	3 .259	2 .284	1 .300	.320	.340	.360	.375	OD
½	1345	1345	1345	45	45	45																	½
⅝	1345	1345	1345	145	45	45	4	4															⅝
¾	1345	1345	1345	1345	45	45	45	4															¾
⅞	1345	1345	1345	1345	1345	45	45	45	4														⅞
1	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	4	4													1
1⅛	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	45	4	4											1⅛
1¼	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	4	4											1¼
1⅜	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	45	4	4										1⅜
1½	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	45	45	4	4								1½
1⅝	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	45	4	4								1⅝
1¾		1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	45	4	4							1¾
1⅞		1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	45	4	4							1⅞
2		1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	4	4							2
2⅛		1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	4	4							2⅛
2¼			1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	45	4	4				2¼
2⅜			1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	45	4	4				2⅜
2½			1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	4	4				2½
2¾				1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	45	4	4			2¾
2⅞				1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	45	4	4			2⅞
3				1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	4	4		3
3¼				1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	45	4	4	3¼
3½				1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	4	4	3½
3¾					1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	4	3¾
4					1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	4
4¼					1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	4¼
4½						1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	4½
4¾						1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	4¾
5						1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	5
5¼						1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	5¼
5½							1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	5½
5¾							1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	5¾
6								1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	6
6¼								1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	6¼
6½									1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	6½
6¾									1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	6¾
7										1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	7
7¼											1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-4	1-4	7¼
7½											123	123	123	123	123	123	123	123	123	123	123	123	7½
OD	22 .028	20 .035	18 .049	16 .065	14 .083	13 .095	12 .109	11 .120	10 .134	9 .148	8 .165	7 .180	6 .203	5 .220	4 .238	3 .259	2 .284	1 .300	.320	.340	.360	.375	OD

On the chart above the figures in the squares indicate the grades (below) which can be supplied in each size:

1-5 —All grades
1345—All grades except Grade 2
1-4 —All grades except Grade 5
123—Grades 1, 2, 3 only (No drawn tubes)
145—All grades except 2 and 3
45—Drawn Grades 4 and 5 only
4—Drawn without mandrel only

OHIO welded tubing grades

Outside flash is removed in all grades. Reference to flash below refers to inside flash.

Grade 1—Flash In

Grade 1 tubing is produced to O.D. and wall tolerances only. The I.D. welding flash is not removed, but does not exceed the wall thickness or 3/32″ whichever is less. Most economical grade for applications where inside diameter is not critical.

Grade 2—Flash Controlled to .010″ Maximum

Grade 2, similar to Flash In tubing except that inside welding flash is controlled to .010″ maximum, has same O.D. tolerances as Flash In grade. Supplied only in diameters 1″ O.D. and larger.

Grade 3—Flash Controlled to .005″ Maximum

Grade 3 tubing is furnished to the closest O.D. and I.D. tolerances that can be held by the welding machine. Inside welding flash does not exceed .005″. Due to closer tolerances, cost is slightly higher than Grade 2.

Grade 4—Welded and Drawn Without Mandrel (Flash In or Flash Controlled)

Since no mandrel is used in drawing, we can work to O.D. and wall dimensions only, no I.D. specifications. Furnished for requirements with closer O.D. tolerances than can be obtained on the welding machine.

Grade 5—Welded and Drawn Over Mandrel

Grade 5 is for applications with closer I.D. tolerance than possible on welding machine. Drawing operation is performed over a mandrel and it is customary to work to O.D. and I.D. specifications. Other characteristics are improved finish and physical properties.

technical information available

Technical handbooks covering various aspects of seamless and welded Ohio Tubing are available. However, since these are constantly being revised and upgraded with the latest information, request free copies direct from the mill and give basic subject matter in which your particular interest may lie. Representative technical data currently available includes:

Mechanical seamless steel tubing

Literature covers definitions, uses, analyses, tolerances, machining information, testing methods and mill practices in regard to Ohio Mechanical Seamless Steel Tubing, and Ohio Airframe Quality and Aircraft Mechanical Seamless Steel Tubing.

Electric resistance welded steel tubing

Processes, characteristics, size range, tolerances, properties and mill practices involved in the production of Ohio Electric Resistance Welded Steel Tubing.

Forging and fabricating facilities

Fabricating and forging facilities available, range and limits to each operation, applications of forged and fabricated tubing and mill practices.

Master weight tables

For round steel tubing include decimal equivalents for fractional parts of a foot, dimensions, and weights of pipe sizes, and weight tables for square, rectangular, hexagonal and octagonal tubing.

Drawn welded steel tubing

Bulletin ERW-2 is an 8-page technical manual. It covers physical advantages, machining and physical properties, and gives data on a cost-comparison basis with seamless tubing.

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225 Broadway, New York 7, New York
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OHIO

OHIO SEAMLESS TUBE

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